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RESEARCH PAPER

Non-Governmental Organizations, Rural Communities and Forests: A Comparative Analysis of Community-NGO Interactions

Glenn Wright · Krister Andersson

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Abstract Scholars, policy-makers and advocates have, in the last decade, recommended greater involvement by non-governmental organizations (NGOs) in community forest management in developing countries. Behind these recommendations lies a notion that NGOs are a sound complement to formal governments and that NGOs can improve communities' abilities to manage their own forests. There is limited empirical work, however, testing how NGO activity affects local forest governance and deforestation. This paper reports the results of quantitative statistical tests on the effects of local NGO importance—as measured by local forest users' reports of NGO importance—on deforestation in a sample of 200 rural Bolivian communities. In addition, it examines the effect of NGO importance on community forestry institutions—specifically, the presence of institutions for rule-making, forest monitoring, sanctioning, and enforcement of rules. Contrary to earlier research, these results suggest that NGOs have no discernible effect on community forestry institutions, though other external actors—most notably, municipal governments—seem to have a positive effect. The paper also reports a negative correlation of NGO importance on deforestation. Although these quantitative results are in part supported by qualitative field observations in selected Bolivian communities, care is needed in drawing generalized causal inferences from this evidence.

Keywords Bolivia · Common pool resources · Local governance · Political institutions · Deforestation · Community forestry

G. Wright (✉)
Department of Social Sciences, University of Alaska Southeast, Juneau, AK, USA
e-mail: glenn.wright@uas.alaska.edu

K. Andersson
Department of Political Science, Institute of Behavioral Science, University of Colorado, Boulder, Boulder, CO, USA

Introduction

In recent years, a wide range of policy actors and scholars have suggested that non-governmental organizations (NGOs) can play an important role in promoting environmental conservation, including at the community level in developing countries (Mittelman 2000; Pretty and Ward 2001; World Resources Institute 2003; Economy 2005; World Resources Institute 2005; Ribot 2008a; Grainger and Obersteiner 2010; Simões et al. 2010). However, the evidence for NGO effectiveness in encouraging effective community forestry institutions is sparse and contradictory. This paper examines the effects of NGOs on community forestry institutions and deforestation, seeking to answer two questions. First, whether NGOs can have an impact on local communities' abilities to manage their own forest resources, and second, whether NGOs have an impact on deforestation directly.

Forest governance is, of course, tremendously complex, involving the interplay of multiple systems, including ecosystems of various scales and sizes, and local, regional, national, and international political conflict. However, forest governance is of increasing importance, with nations and international organizations discussing the use of forest conservation as a goal in its own right as well as a way to reduce global climate change. The analysis presented here seeks to contribute some clarity to the empirical debate on the general effects of NGOs on conservation.

The next section provides an overview of the literature on NGOs and local forest governance. Some background on decentralized and community forestry in Bolivia is then presented, followed by a description of the methodology used. Results of statistical tests on three hypotheses regarding the effects of NGOs on community forestry institutions and deforestation are then reported and discussed. Finally, suggestions are made for future research and a series of policy implications are presented.

Theory and Literature: Institutions, Communities and Forests

Forests, as common pool resources (CPRs), have two notable properties. They can be depleted by over-harvest (referred to as subtractability or rivalrousness), and it is relatively costly to exclude individuals from enjoying the benefits of the resource, which they receive through harvest (called non-excludability) (Ostrom 1990).

Scholars have long recognized that management of CPRs such as forests is a collective action problem which is subject to the 'tragedy of the commons' phenomenon outlined by Hardin (1968). If groups cannot control their members' tendency to over-harvest, CPRs will be depleted, harming all members of the group over the long term. However, groups of people can sometimes avoid the tragedy of the commons by following one of Hardin's two prescriptions—centralized management or the creation of property rights—or, under particular conditions, by following a third approach, which is the informal governance of the resource through the construction of informal institutions (Ostrom 1990). The discussion presented here follows North (1991) in defining 'institutions' as 'the humanly

devised constraints that shape political, economic and social interaction', which can be formal (statutes, constitutions) or informal (customs, norms, taboos).

In developing countries, including in rural Bolivia, forest users often manage CPRs by constructing informal institutions, which take a wide variety of forms and configurations. However, scholars have found that three types of institutions are necessary (though not sufficient) conditions for effective CPR management. These are institutions for rule-setting, monitoring (that is, monitoring of the resource and other users' actions), and sanctioning (typically punishment for rule-breaking). Although not all communities which have these general types of institutions are successful at managing resources sustainably, it is unlikely that communities will be able to successfully manage CPRs without them (Gibson et al. 2005a; Ostrom 1990, 1999, 2003, 2009; Cardenas et al. 2011). For this reason, a measure of these three institutions is used here as a proxy for communities' degree of organization for effective forest management.

NGOs and Community Forestry Institutions

Advocates of NGO activity have argued that NGOs can assist local people in managing their own forest resources sustainably by encouraging the creation of local institutions for forest management (World Bank 2003; World Resources Institute 2003; World Resources Institute, World Bank, UNEP, and UNDP 2005; Ribot 2008a, b). The World Resources Institute (2003) argued that NGOs and other civil society organizations have an important role to play in mobilizing citizens and building institutions for local natural resource management. Ramesteiner (2003) suggested that NGOs can play an important role as a locally impartial agency in oversight of local policies (Rametsteiner 2003). In addition, NGOs may help communities successfully govern local forests by providing financial, technical and organizational support, which can be used to improve communities' own systems for forest governance (Pretty and Ward 2001).

Some empirical research supports these assertions, suggesting that NGOs have been instrumental in gathering information and organizing local citizen participation in conservation, including in Nepal, Bolivia and Brazil (Andersson 2003; Asquith et al. 2008). Andersson (2004), for example, found that in Bolivia, more frequent meetings between NGOs and community organizations are associated with more effective local forestry institutions. Asquith et al. (2008) found that NGOs operating with local communities in and near the Amboró National Park in the Bolivian lowlands have been instrumental in encouraging conservation. They have done so by helping to construct institutions for local participation in a Payments for Ecosystem Services (PES) system. Similarly, Takahashi (2008) found that NGOs have been important in promoting effective community-based forest institutions in Indonesia by facilitating the certification of locally-harvested forest products.

NGOs and Deforestation

Some scholars have argued that NGOs can promote forest conservation directly, without necessarily strengthening community forestry institutions. In Nepal,

Neupane et al. (2002) found that NGO membership was systematically associated with the adoption of agroforestry approaches to prevent erosion and deforestation, and in Bolivia Andersson (2003) observed that NGO demands for forestry services were associated with more forestry service provision in Bolivian municipalities. Also, Ferretti and Debritez (2006) described how NGOs have been instrumental in the creation of forest preserves in Southern Brazil. In short, NGOs may slow deforestation by direct actions, including the promotion of more forest-friendly agricultural practices, actively reforesting and monitoring forests, promoting more stringent regulations, and encouraging government authorities to enforce more energetically existing forestry regulations.

On the other hand, several studies call into question the effectiveness of NGOs in reducing deforestation directly. Engel et al. (2006) used game theory to show that NGO engagement with forest communities may positively affect community livelihoods but that this benefit may come at the expense of local forests. Other scholars have noted that NGOs often are not accountable to local populations, face a set of perverse incentives that make conservation difficult, and lack the awareness of local conditions that are necessary for effective conservation practice (Mohan 2002; Barr et al. 2005; Jepson 2005; Burger and Owens 2010).

This review of scholarly research and advocacy literature about the potential for NGOs to promote forest conservation implies three hypotheses:

H1 NGO importance in local forestry will be positively correlated with the presence of community forestry institutions.[1]

H2 NGO importance in local forestry will be negatively correlated with rates of deforestation.

H3 NGO importance in local forestry will be positively correlated with rates of deforestation.

These three hypotheses are tested implicitly against the null hypothesis (that NGOs will have no effect on deforestation or community forestry institutions).

Although a number of studies have examined similar hypotheses in the past, this paper is the first example of a statistical analysis with a large number of observations, that investigates the impact of NGOs on community forestry institutions and deforestation. There appears to be no other study which examines the impacts of NGOs on biophysical outcomes.

The Study Area

Bolivia is an excellent setting in which to test these hypotheses, because it is a state which has taken community forestry seriously. Bolivia has devolved substantial authority to communities, which have in recent years been provided with the legal

[1] 'NGO importance' is measured as local residents' assessments of the importance of NGOs in local forestry management. 'Community Forestry Institutions' include institutions for rule-setting, monitoring and sanctioning. These variables are described in greater detail in 'Descriptions of Variables for Analysis,' below.

tools to manage local forests according to locally-generated (sometimes traditional) rules. Although many Bolivian municipalities have been unwilling or unable to take advantage of formal structures which have been created for community forestry since the 1990s, most Bolivian communities exhibit some degree of community forestry management. Many communities also consider NGOs to be important for forestry, but there is substantial variation in this regard, providing variation on the independent variable considered in this paper.

Decentralization and Community Forestry in Bolivia

Before 1994, Bolivia was formally organized as a federal state, with local, provincial, regional and national governments. However, as in most other Latin American countries, few powers and fewer resources were granted to sub-national units of government, resulting in a government that functioned as a highly centralized state (Andersson 2003; Andersson et al. 2006). This de facto centralization changed dramatically in the mid-1990s, when the Congress of Bolivia passed the 1994 Ley Participación Popular, or *Popular Participation Law*—essentially a package of decentralization reforms which granted substantial authority and resources to municipal governments, and created new institutions for accountability at the local level. Under this law, 20 % of national tax revenues were to be granted to Bolivian municipalities (of which there are over 300) and the reform also created new local-level institutions for accountability (de Jong 2004; Oemer 2004; Pacheco 2006).

Decentralization in the forestry sector has been less dramatic, but the 1996 Ley Forestal 1700 (*Forestry Law 1700*) was designed to encourage sustainability in the forestry sector by lengthening the tenure of forestry concessionaires and improving the security of tenure for the forest-dependent poor by creating new legal mechanisms for the communal management of local forest resources. Prior to the law, Bolivian lowland forests had been managed through a system of concessions in which forestry firms were granted non-renewable leases for five years, during which time they would have the right to extract timber from a given territorial concession. The 1996 *Forestry Law* increased the term of these concessions to up to 40 years, made them renewable, and strengthened rules regarding forestry management practices in order to encourage sustainable forest management.

The Forestry Law and earlier presidential decrees promoted two new types of organizations which can be used for community forest governance. These organizations—Asociaciones Sociales del Lugar (ASLs or Place-based Social Associations) and Tierras Comunitarias de Origen (TCOs or Original Community Lands)—are the mechanisms that communities can legally use to manage forests, bringing them into compliance with Bolivian national law. ASLs and TCOs are designed as communal management organizations for forests claimed by non-indigenous social groups and indigenous groups, respectively. Concurrent reforms also permitted existing social organizations and indigenous groups to file claims for land. These claims would then be mediated by the central government, in theory resulting in exclusive communal management rights for these existing organizations, which would become ASLs and TCOs. Once these organizations were formed, TCOs became indigenous lands managed through traditional indigenous

institutions, and ASLs were managed by social groups through the authority of municipalities (Pacheco 2006).

ASLs and TCOs have become successful examples of community-based forest management although many locations lack ASL or TCO status, and sometimes lack any legal right to forest goods. However, the 1996 *Forestry Law* and related reforms created, for the first time, formal mechanisms by which forest communities could legally manage their own forest resources. These reforms have had uneven effects throughout Bolivia, but Bolivian communities now have more tools than ever before to formalize the local management of forests. To date, there has been relatively little research on the effects of other factors—such as the presence of NGOs—on Bolivian community forestry management, and most research which has been conducted has been limited to descriptive case studies with a single case or a small number of cases (de Jong 2004; de Jong, Ruiz and Becker 2006; CIFOR 2007; Cronketon et al. 2010). Though case studies are helpful, they should be complemented with quantitative research examining a larger number of cases, through analysis such as that presented here.

Research Method

The three hypotheses were tested through the use of generalized linear regression techniques on a unique cross-section dataset of 200 rural Bolivian communities. The communities included in the analysis were selected using a stratification process by which 100 municipalities were randomly selected from the full population of rural Bolivian municipalities (urban municipalities with more than 200,000 residents were excluded). Within each of these municipalities, two communities were randomly selected for focus group research, providing a sample of 200 communities spread throughout Bolivia, including both highland and lowland areas, and representative of Bolivian rural communities more generally.

Data used here includes: (a) user-reported measures of deforestation, (b) data on deforestation generated using remote sensing techniques, (c) data on community forestry institutions, and (d) economic, political, and social data on forest users, local populations and intergovernmental relations. Two statistical models are used to examine the relationship between NGOs and deforestation, and another model examines the relationship between NGOs and local community forestry institutions.

Much of these data were generated in community focus group workshops held in each of the 200 communities in 2007. Each workshop included approximately 20 participants. Bolivian researchers affiliated with CERES, a research institute in Cochabamba, held focus group discussions with these individuals, who were asked a series of about 150 survey questions about their relationship with forest resources as well as with external organizations working in forestry. Answers to these questions were generated by consensus, and these answers were used to create most of the variables for statistical analysis. Additional data on demographics and location were drawn from the Government of Bolivia's national census data from 2001.

Descriptions of Variables for Analysis

In the models presented here, there are two dependent (outcome) variables, two independent variables of interest and several control variables. Statistical summaries of all of these variables are presented in Table 1.

Two types of variables are modeled here as outcomes or dependent variables. The dependent variable used to test H1—'community forestry institutions'—is a proxy for the extent to which communities have developed institutions for forest governance and management. This variable is derived from the focus group sessions in each of the 200 communities, where participants were asked whether each community had several types of institutions. The variable is simply the count of how many of the following types of forestry institutions each community has: institutions for rule-making, institutions for monitoring, institutions for enforcement, and institutions for sanctioning. This count measure ranges from 0 (none of these types of institutions) to 4 (all four are reported present). This variable is also used as a control in the deforestation models presented here.

The second type of dependent variable—used to test H2 and H3—includes two types of measures of deforestation in each of the 200 communities. One was derived from workshop participants' responses on the total amount of deforestation in the previous 10 years. This community-generated data was used to generate an annualized rate of deforestation. Because formal-legal property rights often differ from customary rights, this measure was generated from focus group questions in which community members were asked how much forest area is 'of the community'. These 'community lands' are often not formally-recognized ASLs or TCOs, and often formal property rights differ from local, conventional understandings of community land.

Table 1 Statistical summaries of variables in regression analysis

Variable	Observations	Mean	SD	Min	Max
Deforestation rate, remote sensing (percentage/year)	165	0.07	0.21	0.00	1.00
Deforestation rate, user reported (percentage/year)	200	0.05	0.07	0.00	0.35
Community forestry institutions (count of institutions)	200	1.48	1.34	0.00	4.00
NGO importance	200	0.83	1.25	0.00	3.00
Central government importance	200	0.26	0.72	0.00	3.00
Regional government importance	200	0.35	0.84	0.00	3.00
Municipal government importance	200	0.99	1.31	0.00	3.00
Forest cover (ha, natural logarithm)	200	4.34	3.07	−2.30	14.77
Distance to health clinic (km)	200	6.09	9.20	0.00	65.00
Population (natural logarithm)	200	5.27	1.00	2.30	8.52
Indigenous population (%.)	200	10.71	29.37	0.00	100.00
Land inequality (differences in ownership among population)	200	5.25	2.62	1.00	10.00
Property rights (land titling)	200	0.57	0.51	0.00	2.00

The second measure of deforestation was generated using remote sensing data. GIS software was used to generate a map of approximate community boundaries, based on community members' workshop responses for the size of the area utilized by the community, assuming that communities are circular in shape with the origin of each circle at the village centre. Forest cover data from 1998 and 2008 were then used to generate a map of the total forest cover change in each community. Then, forest cover on these maps was measured, to generate a sum total of deforestation between 1998 and 2008. This change was then used to generate an annual rate of deforestation in that period.

The two measures of deforestation used have strengths and weaknesses, and both may be subject to measurement error. Generating data from remote sensing required assumptions about the shape of the area utilized by 200 sampled communities. Workshop participant-reported data assumes that workshop participants are familiar with, and can quantify accurately, the total area of forest cover in their jurisdiction. Both deforestation measurement techniques may produce statistical results with inflated standard errors that would make achievement of statistical significance more difficult. However, there is no reason to believe that either measure is systematically biased in either a positive or negative direction, nor that these errors will be correlated with other explanatory variables.

The 'NGO Importance' variable was generated using a series of questions asking workshop participants to name the first, second and third most important external organizations participating in forestry activities in their community. If no NGO was named, the variable was coded 0, if an NGO was listed as the third most important organization, the variable was coded as a 1, if the second most important organization was an NGO, the variable was coded as a 2, and if the first most important organization listed was an NGO, the variable was coded as a 3. If more than one NGO was listed, the highest value was taken.

Variables for 'Central Government Importance,' 'Regional Government Importance' and 'Municipal Government Importance' were constructed using the same rating method as 'NGO Importance'. These variables were included because previous studies (e.g. Ostrom et al. 1993, 2007; Ostrom 1999; McGinnis 1999; Dietz et al. 2003; Ribot 2008b; Andersson and Ostrom 2008) have indicated they influence deforestation and because they may be correlated with NGO importance.

Total forest area in the municipality (natural logarithm transformation)[2] is included as a control in the first model. In each model, 'distance to health clinic' was included to control for the remoteness of each community, and is intended as a proxy for the differing expense of extracting timber. Community population (natural logarithm transformation) was also included to control for pressure on forest resources.

Three other variables (identified by Baland and Platteau 1999; Ostrom 2003; Leigh 2006) may be associated with the emergence of community forestry institutions, and hence with deforestation. These were also included as controls, because they may be correlated with NGO importance. One is 'land inequality,'

[2] The natural logarithm of the raw value was used to transform raw area (in ha) to a normal distribution. The same transformation was used with community population.

measured as the median response to a question phrased, 'From 1 to 10, where one is little difference and 10 is a great deal of difference, are there differences in land ownership between those who have the most and those who have the least in the community?' Another is 'property rights,' which is a measure, from zero to two, of the progress the community had made in a national land titling program. Communities which had not begun the program received a 0, communities which had been surveyed received a 1, and communities which had received their title were coded as a 2. The third control variable is indigenous population, as a percentage of total population in each community.

Statistical Methods Used

Extradispersed Poisson regression has been used to analyze the data. This technique is appropriate where dependent variables are measured as counts or proportions, approximately following a Chi-squared distributed (Cameron and Trivedi 1998; Hoffman 2004; Rabe-Hesketh and Skrondal 2008). To confirm that the findings here are not solely a result of the estimation technique used, these models were re-tested using several alternative techniques (extradispersed Poisson regression with alternative extradispersion adjustments, negative binomial regression, zero inflated Poisson, and negative binomial regression techniques), generating substantively similar results except where noted below.

One complexity in modeling deforestation is related to the fact that, although a small number of communities had net deforestation, count models such as those used here cannot be used where values of the dependent variable (here, deforestation) are below zero (Cameron and Trivedi 1998; Hoffman 2004; Rabe-Hesketh and Skrondal 2008). Therefore, deforestation rate in nine municipalities which experienced net forest growth between and 1993 and 2007 was recorded as zero.[3] Truncation of the deforestation rate should have the effect of making detection of a statistically significant relationship between NGO importance and deforestation more difficult, making the results presented here more striking.

Negative deforestation rates in workshop participant-reported deforestation data were also recorded as zero. OLS regression was used to ensure that results were not due solely to statistical modeling technique (skewness was less of a problem with this variable) generating similar results.

All of the models presented here were tested with the full range of necessary robustness checks and postestimation tests, including re-running regression models after removing observations with high Anscombe, Pearson and deviance residuals,[4] examining the normality of residuals, graphing residuals against independent variables to diagnose misspecification of functional forms, and removing and adding control variables singly and in groups to test the sensitivity of these results to omitted variable bias. The models were also tested with several estimation

[3] None of these municipalities experienced forest cover growth rates of more than 1% per year. This model was further tested with several other appropriate count data estimation techniques, all of which generated similar results.

[4] These are three different measures of the error of the statistical model, used for generalized linear models to diagnose the influence of outlier observations.

techniques, including alternative adjustments for extradispersion, and by using negative binomial and zero-inflated binomial and Poisson regression.

Supplementation of the Statistical Analysis by Qualitative Methods

In addition to the statistical analysis presented here, qualitative evidence is used to illustrate and explore potential causal pathways. Qualitative data were gathered in the course of approximately one year of qualitative fieldwork, from May 2008 to July 2009, in the same municipalities (but not necessarily the same communities) used to gather the statistical data presented here. This data was gathered, not in structured surveys, but in unstructured, qualitative interviews with community leaders, mayors, and government officials in Bolivian rural communities. Interviewees were sought using 'snowball sampling', in which interviewees were asked to provide names of other potential interviewees. The qualitative data presented here are all drawn from the municipality of Sorata, Bolivia, in the Yungas region north of La Paz. Interviews in Sorata took place in May of 2009.

Results

Characteristics of Sampled Communities

The communities sampled were overwhelmingly rural and *mestizo* (mixed indigenous and European ethnicity). The average distance to a major road was 9 km, and 50 % were less than 3 km from a major road. Communities were about evenly divided between lowland and highland municipalities (108 and 92 respectively). The average reported proportion of indigenous residents was 10 %, but the distribution of indigenous population was bimodal: 83.5 % of communities reported no indigenous residents, and about 11.5 % reported that 100 % of residents were indigenous in origin. Most communities had a relatively long history of settlement (average settlement date was 1941, 79 % were settled by 1970, and 5 % before 1900), and 12 % had some type of association for forest management, including both ASLs and TCOs. The average community population size was about 34 residents, with a minimum size of 10 and a maximum of 5,000. About 55 % of the sampled communities had fewer than 200 residents.

The communities sampled for this study exclude large, urban municipalities (with more than 200,000 residents), but are otherwise representative of Bolivian communities. In area, they range from very large (191,727 km^2) to very small (15 km^2), and they are similarly diverse in terms of population (between 31 and 159,572 residents, with the mean about 18,000). In the lowlands, 28 are in the Department of Santa Cruz, 14 in Cochabamba, 6 in Beni, 7 in Pando, and 1 in Tarija (13 are also in Chuquisaca, but these are generally in the highland portion of the department). Finally, the municipalities are diverse in terms of municipal income, with municipal budget sizes (in 2007 USD) from about $1600 to over $2 M but with about half having an income below $662,000. In general, these are not wealthy municipalities, but most have sufficient income to pursue effective policy.

In most of these communities, most forests are managed through an informal, locally-generated management system. Only three of the communities were found to have substantial areas with central government-approved *commercial* forest management plans, and only four claimed control over substantial areas managed by forest concessionaires. Even in these cases, concessions made up less than 15 % of the total forest area of the community area. Instead, a substantial number of communities followed some central government approved *traditional* management plan (36 % with more than 10 % of their forest area and 12 communities using 'simplified management plans' implying some form of communal management), and many of these communities have substantial forest area managed by individuals (65 % with more than 10 % of their forest area managed by individuals). Most of the selected municipalities also reported no continuing forest concession or extraction activity at the hands of formally-constituted forestry firms. Eighty-two of 100 municipalities (from which the sample of 200 communities were selected) reported no forestry firm activity in the municipality, and only seven reported activity that could be due to large-scale firms (with 15 or more employees).

NGOs in the Study Area

The NGOs noted in the dataset used here include aid organizations (UNICEF, Save the Children, and other local poverty alleviation NGOs), NGOs with a forestry or conservation-related mission, and faith-based NGOs. Approximately 25 % of the NGOs were focused on conservation-related activities, about a third were aid organizations, and the remainder either faith-based NGOs or organizations which are difficult to classify. Groups included international NGOs (UNICEF, SWISSKONTACT) as well as local organizations. In 19 of the sampled communities (about 10 %), at least one NGO was listed as one of the three most important organizations for forest governance, though only a few NGOs (mostly large international ones) were important in more than one municipality. Although it is highly likely that a larger number of sampled communities have some NGO presence, only NGOs which were considered 'important for forestry' are present in the results.

Findings from Regression Analysis

Regression analysis generated two interesting sets of results. As indicated by Table 2, in Model 1 in which the dependent variable is 'Community Forestry Institutions', the importance of NGOs is not associated with the presence of community forestry institutions. These results, therefore, provide new evidence that community forestry institutions are more likely where NGOs are more salient. By contrast, municipal government importance is strongly and significantly associated with community forestry institutions.

NGO importance is associated with relatively low rates of deforestation. In both model 2 (where the dependent variable is workshop participant-reported deforestation) and model 3 (where the dependent variable is remote sensing-generated data on deforestation), 'NGO Importance' is significantly and negatively correlated with

Table 2 Regression results

Model	1	2	3
Dependent variable	Community forestry institutions	Deforestation/year (participant reported)	Deforestation/year (remote sensing)
Model type	Extradispersed poisson	Extradispersed poisson	Extradispersed poisson
NGO importance	0.03	−0.01	−0.29
	0.59	0.00**	0.04*
Central government importance	0.03	−0.00	−0.56
	0.73	0.54	0.18
Regional government importance	0.01	0.00	0.28
	0.94	0.66	0.04*
Municipal government importance	0.21	0.00	−0.22
	0.00***	0.73	0.12
Forest area (km^2, natural logarithm transformation)	0.05		
	0.04*		
Institutions for self-governance		−0.01	−0.13
		0.08	0.26
Distance to health clinic	0.00	−0.00	−0.02
	0.60	0.04*	0.35
Population (natural logarithm transformation)	−0.07	0.01	0.44
	0.33	0.01*	0.00**
Indigenous population (%)	0.00	−0.00	0.01
	0.23	0.31	0.07
Land inequality	−0.04	−0.00	0.01
	0.14	0.30	0.87
Property rights	−0.13	0.01	0.64
	0.35	0.30	0.04*
Intercept	0.45	0.00	−5.04
	0.27	0.88	0.00***
Observations	200	200	165
BIC	−753.63	−1,000.54	−752.64

P scores in parentheses; * significant at $P < .05$; ** significant at $P < .01$; *** significant at $P < .001$

deforestation. Statistical testing for Models 2 and 3 reveals that community forestry institutions are not significantly associated with either citizen-reported or remote sensing-generated measures of deforestation.

One concern about the appropriateness of these models may be that, due to the heterogeneity in social and ecological settings between communities, statistical results may be reflective of omitted variable bias, because of a failure to control for differences between highland and lowland municipalities. However, the 'highland' dummy variable was found to be not statistically significant, and have little effect on coefficients for other explanatory variables. Further, the models presented here were

re-tested using controls (dummy variables) for Bolivian regional jurisdictions. The addition of these variables had no effect on the direction or significance of other independent variables.

It should be noted that the 'NGO salience' variable in a few of the deforestation models was sensitive to the exclusion of outliers, though this was not the case in all the models tested, and models where the dependent variable was forest cover (logged) were robust to the exclusion of outliers, giving similar results to those reported here. In the extradispersed Poisson models, residuals tended to diverge from normality because of the long right tail of the distribution of the dependent variable. However, this problem is addressed by the extradispersion adjustment in the model.

Figure 1 shows the relationship between NGO importance and deforestation. A shift from low to high NGO importance (0–3) is associated with a decline in the average rate of deforestation, from over 6 % to <3 %. The graph also shows 95 % confidence intervals around point estimates with all control variables held at their medians.

Discussion

According to the analysis presented here, NGO importance does not appear to be related to community forestry institutions for rule setting, self-monitoring, or rule enforcement (sanctioning). However, there is some evidence that NGO importance is associated with lower rates of deforestation (where there are more NGOs, forests shrink more slowly). These findings may be the result of a causal relationship—that

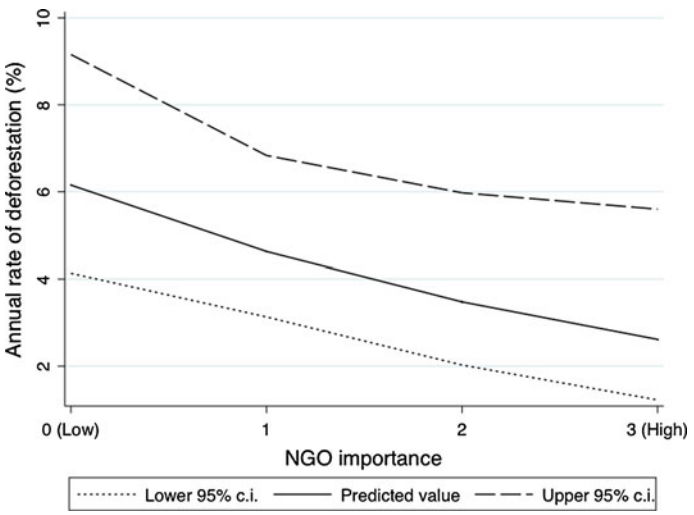

Fig. 1 Effect of NGO importance on rates of deforestation (Though these confidence intervals are somewhat wide, the relationship is statistically significant at the 95% level. These predicted values are based on regression Model 3)

NGOs promote lower rates of deforestation—or may be spurious. There may be reasons to believe that NGOs have a direct, negative effect on deforestation, but these results are ambiguous in this regard and should be taken with caution.

Model 1 tends to disconfirm the first research hypothesis (H1), that NGO importance is positively correlated with community forestry institutions. This result is consistent with the idea that NGOs do not promote improved community forestry governance, as scholars and policy-makers often assert. On the other hand, regression Models 2 and 3 tend to confirm hypothesis two, that NGO importance is negatively correlated with deforestation rate. At a minimum, this second set of results suggests that NGOs do not *promote* deforestation (contradicting H3), and imply that NGOs may *prevent* deforestation directly (consistent with H3).

These results present an interesting paradox. Where NGOs are considered important by the local population, deforestation is lower, but communities are no more likely to have institutions for forestry rule-making, monitoring and sanctioning. If such institutions are a necessary condition for sustainable forest management, as posited by Ostrom (1999) and Ribot (2008a, b), NGOs do not appear to improve communities' abilities to effectively govern their own forests. That is, although NGO importance is associated with lower rates of deforestation, the results presented here, taken together, tend to undermine the causal pathway posited in the literature, which asserts that NGOs will reduce deforestation by improving community' ability to govern their own forests, especially by promoting community forestry institutions.

What does explain these apparently divergent results? Three possible explanations are advanced here, using qualitative data, and with reference to the municipality of Sorata in Bolivia. Sorata, about five hours North of La Paz, located in the Yungas Region, is a place where NGOs are strikingly important in governance of all kinds, including forest governance. Indeed, the only visible evidence of any governance activity in Sorata observed by the authors on a visit in May of 2009 was associated with development NGOs. Local residents and community leaders argued that the mayor and municipal council were corrupt and unresponsive to local needs and demands. Instead, two faith-based NGOs—'Caritas' and 'Misión Alianza Norwega' or MAN—were associated with development projects and the provision of some services that would normally be the purview of government, including road maintenance and other infrastructure development. Both organizations are faith-based NGOs, the first associated with the Catholic church and the second with the Norwegian Baptist church, and both organizations had only been involved in Sorata relatively recently—Caritas since 2007, and MAN since 2003.

One possible explanation for these apparently anomalous results is that NGOs lack the time- and place-specific knowledge needed to promote effectively institutions for forest governance, as opposed to more general information needed to prevent deforestation. In Sorata, however, employees and volunteers with MAN and Caritas could speak in convincing detail about the communities in which the organizations worked, promoting a wide range of projects, including reforestation. NGO personnel appeared to have greater knowledge of the communities in which they worked than municipal personnel, and had greater access to time- and place-specific knowledge

than most other locals. Qualitative work in other municipalities suggests that this detailed knowledge of local communities is not limited to Sorata. Therefore, a lack of information about local conditions is likely not the reason for the apparent absence of a relationship between NGO importance and community forestry institutions.

The second possible explanation is that NGOs prefer to operate in places which are poorly self-organized and lack local governance institutions, either because these are the locations where they can do the most good, or because these are the places where they will meet the least resistance in pursuing their own policy goals. NGOs are to a substantial degree able to choose their work sites, making it possible that the absence of a relationship between NGO importance and community forestry institutions is the result of a selection process in which statistical results are biased by the tendency of NGO to choose relatively unorganized work sites. However, observations suggest that there is no relationship between NGO willingness to locate in a particular setting and the level of organization of that setting's population. NGO employees in Sorata and elsewhere expressed an interest in working in communities with well-organized local populations, which they argued were easier to work with, and where projects are longer-lasting and more effective as a result of community abilities to self-govern, though they would sometimes also work with poorly organized communities because of their greater need. Indeed, in Sorata NGOs had chosen to work with several communities primarily at the behest of the communities themselves, which already had sufficient organization to seek help from the NGOs. Further, both NGOs sought to avoid working with the municipal government as much as possible, on account of its poor organization.

A third possibility is that NGOs may seek to produce visible results that they can easily display to potential donors. This idea is theoretically well-developed in Gibson et al. (2005a, b) and is consistent with findings on the activities of NGOs in the Peruvian Andes (Bebbington 2005). In forestry, NGOs can more effectively seek funding by measuring success in tangible ways (number of trees planted or hectares reforested) and therefore have an incentive to pursue projects and activities in which such relatively tangible metrics can be easily used. The promotion of local institutions may be an area which is less tangible, and therefore less supportive of NGO funding structures and procedures. In short, NGOs may believe that donors will be less willing to donate funds which will be used to promote governance, and more willing to donate funds which will be used to plant trees. In Sorata, NGOs were interested in constructing buildings, irrigation infrastructure, schools and health clinics, promoting small-animal care and providing technical assistance for agriculture. That is, NGOs were happy to perform tangible projects in infrastructure improvement, but interview subjects reported no interest in promoting citizen self-regulation or the creation of local institutions for self-governance.

Conclusion

Much recent research suggests that NGOs may play a strong role in environmental governance. However, much recent optimism regarding NGOs in natural resource management may be misplaced. Using survey data and remote sensing data on

forest governance, demographics, and deforestation from 200 communities in rural Bolivia, statistical tests of the relationship between NGO importance and community forestry institutions and of the relationship between NGO importance and deforestation suggests that NGOs are not associated with community forestry institutions, but they are associated with lower rates of deforestation. No evidence was found that NGOs affect local institutions for forest self-governance. Communities where NGOs are considered important had similar numbers of institutions for forestry self-management as other communities. This suggests that NGOs rarely have a tangible impact on communities' abilities to manage their own forest resources. These research results do not imply that NGOs can play no practical role in promoting forest conservation in the developing world. Rather, they provide some tentative evidence that deforestation may be slowed by NGO involvement. However, no evidence was found that NGOs systematically contribute to *higher* deforestation rates, as argued, for example, by Engel et al. (2006).

These results also reflect the great complexity of forest governance and the difficulty of creating systems for effective and sustainable management of community forest resources. While policy advocates have often recommended one-size-fits-all solutions to problems of conservation and forest governance (including calls for greater decentralization and intervention by NGOs), no single solution is likely to prevent all deforestation, and indeed a multitude of solutions are likely necessary to address global problems of deforestation and forest degradation.

There are several questions that this research leaves unanswered. One is the extent to which different types of NGOs may have different effects on deforestation and community forestry institutions in settings like those studied here. In addition, the relationship observed between municipal government importance and community forestry institutions, and the absence of a relationship between community forestry institutions and deforestation, deserve further investigation. Why is it that community forestry institutions seem not to have an impact on deforestation, and why is it that municipal governments seem to have a greater impact on community forestry institutions than do other factors, including NGOs? Despite the persistence of these questions, the analysis presented here is an important step forward in the understanding of community forestry.

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